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Workshop on Advances in the Use of Historical Marine Climate Data

By Henry Diaz, Chris Folland, Teruko Manabe, David Parker, Richard Reynolds and Scott Woodruff

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A Workshop on Advances in the Use of Historical Marine Climate Data was held at the NOAA Climate Diagnostics Center, Boulder, Colorado, USA, 29 January-1 February 2002. It was organized by NOAA, the UK Met Office and the Japan Meteorological Agency and was sponsored by the Global Climate Observing System (GCOS) and WMO.

Scope

The overall intention was to build on the recent blend of the US Comprehensive Ocean-Atmosphere Data Set (COADS) with the Met Office Marine Data Bank and several million newly digitized data. This blend provides the climate research community with an unprecedented assembly of *in situ* marine data. There have been major improvements in data availability up to the mid-20th century. The new observational archive has been named the International Comprehensive Ocean-Atmosphere Data Set (I-COADS).

Proceedings

The Workshop began with presentations on historical marine datasets, sea-surface temperature (SST) and sea ice, marine air temperature, mean sea-level pressure (MSLP) and wind, and recommendations from the second CLIVAR Climate of the Twentieth Century (C20C) Workshop. Three breakout groups covered SST, air temperature and sea-ice; MSLP and wind; and technical requirements. These groups made recommendations, summarized below. General background to the recommendations includes the need to reduce the remaining biases in the data; to increase, where possible, coverage and temporal resolution; to specify uncertainty in analyses; to distinguish versions of datasets; and to promote easy access to all data. A staged timetable for implementation was agreed: firstly, a two-year period would lead to the third C20C Workshop around April 2004; and, secondly, a period of about five years would lead to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

Recommendations

SST, air temperature and sea-ice

Within two years:

- Re-examine the historic bias corrections to SST, especially for the late 1930s until the end of the 1940s;
- All the metadata in the issues of publication WMO-No. 47 (International List of Selected, Supplementary and Auxiliary Ships) should be digitized; biases in recent night marine air temperature (NMAT) data should be evaluated, and NMAT interpolation techniques should be reassessed;
- Use geostationary satellite and moored-buoy data to analyse the diurnal cycle of SST, particularly in the tropical west Pacific warm pool. It was recommended that the Voluntary Observing Ship Climate (VOSClim) Project be extended or a parallel project be initiated, to include buoys;
- Commence regular comparisons of the quality control (QC) procedures for SST. For these, common *in situ* input data should be used;
- Collate NOAA Pathfinder satellite SSTs for inland seas and large lakes;
- Develop sub-monthly analyses of SST since 1950;
- The Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) Expert Team on Sea Ice (ETSI) should provide recommendations on the blending of sea-ice data and the interpretation of microwave observations of sea ice. This would provide much needed information on variations in sea-ice thickness;
- It is desirable that the ETSI should provide an inventory of historical sea-ice data for the Southern Ocean;
- The use of satellite SSTs in relationships between SST and sea-ice concentration should

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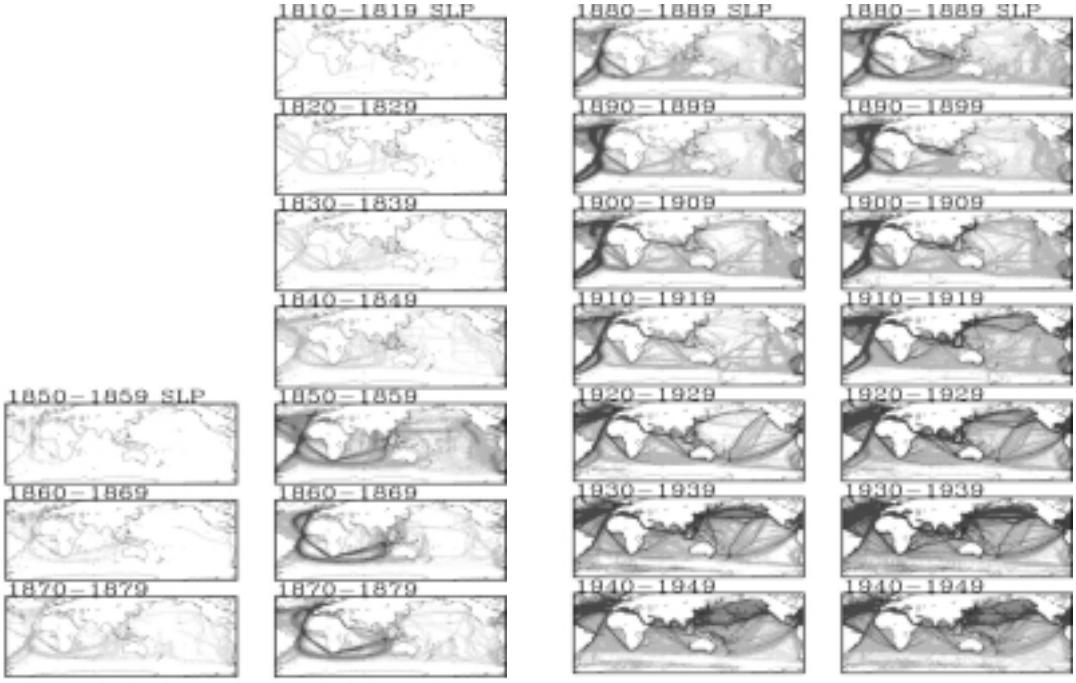

Decadal coverage of mean sea-level pressure data over the oceans, COADS (left panels) and I-COADS (right panels), 1810-1819 to 1940-1949. White in a two-degree box indicates zero observations in the decade. Four increasingly dark shadings indicate: 1-9, 10-99, 100-399, or 400 or more.

be re-assessed, owing to possible contamination of the SSTs by the sea ice. Improved sea-ice data and relationships should be incorporated into SST analyses.

Within five years

- Cloud-clearing techniques for satellite-based infrared SSTs should be compared;
- Regular comparisons of SST analyses should commence;
- All SST analyses need to include gridded fields of analysis error, including bias correction error. Error covariances are also needed;
- Create monthly and sub-monthly blended SST/sea-ice products. Estimates of errors and indications of sources of data should be included in the product.

Mean sea-level pressure and wind

Well within the two-year timeframe and ideally by early 2003:

- The Hadley Centre global monthly MSLP dataset (HadSLP) should be updated;
- The terms of reference of the GCOS MSLP Working Group should be expanded to include surface winds;
- A catalogue of available wind and pressure products should be developed.

Within two years

- Florida State University would have a non-global (Pacific & Indian Oceans) dataset of surface wind and MSLP, fluxes, and related variables from 1950 onwards;
- Appropriate techniques for the adjustment of both estimated and measured wind speed observations should be investigated and applied;
- Monthly wind statistics for 1854 to date should be computed using the adjusted estimated and measured winds;
- The Meteorological Service of Canada has created a high-resolution analysis of winds over the North Atlantic for 1958-1997. The use of historical daily MSLP fields to backdate this analysis should be investigated;
- Biases from the US Maury Collection pressure dataset should be investigated;
- More observations on pressure are needed to improve historical MSLP analyses;
- The new JCOMM buoy metadata base should be populated with current and historical data.

Matthew Maury (Photo: Library of Congress, Prints & Photographs Division [reproduction number LC-B8172-1335], (Brady National Photographic Art Gallery (Washington, DC))

Merged COADS and WMO-No. 47 data 1980-1997 should be made available.

In the five-year timeframe

- Improved monthly (and daily if possible) surface pressure for land stations should be made available for blended land-marine analysis;
- Improved re-analysis techniques, currently being developed, should be used to produce a combined daily MSLP and surface wind product for as much of the world as possible back to the late 19th century;
- For all gridded datasets, error estimates of wind and pressure should include grid-box uncertainties and error-covariance structures.

Technical requirements

For continual action, without a specific timeframe

- Data that add the most information to the existing database should be given priority for digitization;
- The research community should have access to preliminary data. Identification and documentation should clearly distinguish final from interim products, and advise users of potential duplication and lack of QC in the interim products;
- Use a new, fully documented format for interim and newly digitized data;
- Continue development and application of new QC techniques and utilization of metadata;
- Continue wide distribution of all data in appropriate formats, and share software to access and analyse the data. Data should be available freely, e.g. over the Internet, or at a minimum cost for media.

Within 2 years

- Real-time data collection centres should keep original copies of the GTS data stream. A comparison of GTS receipts at these collection centres should be made;
- Modern high-quality data, at a higher observational frequency than standard synoptic periods, should be incorporated in I-COADS;
- There should be a mirror data site for the new I-COADS database.

Conclusion

The Workshop achieved its goals by:

- Creating a timetable for further enhancement of *in situ* marine datasets;
- Developing a strategy for creating and comparing alternative SST, sea-ice concentration and marine air temperature analyses, to provide estimates of uncertainty in analyses and key diagnostics of climate variability and change, and to allow assessment of the effects on atmospheric general circulation models of legitimate uncertainties in the analyses;
- Taking account of recommendations made by the second Workshop of the CLIVAR C20C Pro-

The Workshop thanked Dr Joseph O. Fletcher (left), who inspired the original COADS project in the 1980s. Several speakers acknowledged his major contributions, and participants signed a certificate in his honour.

ject. These included acquiring current and historical SST data for inland seas; archiving quality-controlled SSTs and their uncertainties for assimilation into coupled GCMs; assembly of tropical skin SSTs to test model sensitivity to their use and to the diurnal cycle; provision of analyses with estimates of error associated with each grid-box; testing the sensitivity to use of alternative SSTs; creation of sub-monthly SST analyses from 1950; acquisition of sea-ice thickness information to improve heat fluxes; incorporation of historical Russian sea-ice data;

- Proposing the further development of analyses of marine surface pressure and winds, with support from the new GCOS MSLP Working Group.

In its final plenary session, the Workshop voted in support of the name International Comprehensive Ocean-Atmosphere Data Set (I-COADS) for the new blended observational database. This name recognizes the multinational input to the database while maintaining continuity of identity with COADS, which has been widely used and referenced. The Workshop was an appropriate lead-in to the conferences planned by JCOMM for September 2003 in Brussels, to commemorate the 150th anniversary of the conference convened in Brussels in 1853 by US Navy Lt. Matthew Fontaine Maury to establish, *inter alia*, the standardization of meteorological and oceanographic observations from ships at sea. Maury's work (see Lewis, 1996) remains the foundation of much operational and research maritime meteorology and oceanography.

Reference

LEWIS, J. M., 1996: Winds over the World Sea: Maury and Köppen. *Bull. Amer. Meteorol. Soc.*, 77, 935-952.